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(54) IC package and IC card incorporating the same thereinto.

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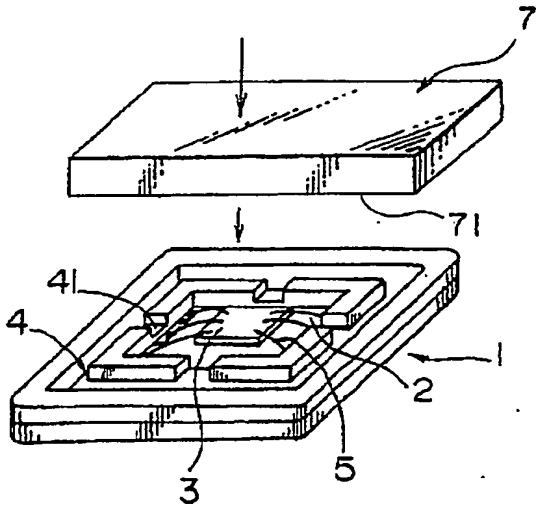
FIG. 2



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IC PACKAGE AND IC CARD INCORPORATING THE SAME THEREINTO

FIELD OF THE INVENTION AND RELATED ART STATEMENT

This invention relates to an IC (integrated circuit) package. It also relates to an IC card incorporating such an IC package thereinto.

In the production of a conventional IC package, a surrounding wall is placed on an IC package substrate to define therebetween a cavity. An IC chip is placed on the IC package substrate within the cavity. A wire bonding is carried out between the IC chip and the terminals. A liquid viscous resin material of an amount more than required is filled into the cavity by potting. Examples of such liquid viscous resin material include epoxy resin and silicone resin. After the resin is cured or set, the excess of the resin is removed by grinding, thereby adjusting the flatness and thickness of the IC package.

However, recently, to meet the requirement for saving the power consumption of an IC package and the requirement for compactness of the IC package, the IC package substrate as well as the potted resin has become thinner. As a result, there have been encountered problems, such as the generation of stresses in the IC chip and of disconnection of bonding gold wires because of the grinding operation.

OBJECT AND SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide an IC package and an IC card comprising the same, requiring no grinding operation.

There is provided an IC package comprising:
an integrated circuit chip;
a substrate on which the integrated circuit chip is mounted;
a wall for surrounding the integrated circuit chip, the surrounding wall being placed on the substrate to define therebetween a cavity and resin for sealing the integrated circuit chip, with which the cavity is filled.

According to the present invention the IC package is characterized by
recess means provided in the surrounding wall, the recess means communicated with the cavity; wherein said resin additionally fills the recess means.

According to the present invention, when the resin of an amount more than required is filled in the IC package, the excess of the resin not contributing to the plastic-sealing of the IC chip is received in the recess means. Therefore, without the use of a grinding operation, there can be produced the IC package having a high degree of flatness and a high precisely controlled thickness. Since the grinding operation is not needed, the above-mentioned problems are not encountered, and the IC package can be produced at lower costs in a higher yield.

Preferably, the capacity of the recess means is substantially equal to a volume corresponding to a difference between the maximum volume of the resin to be filled and a volume of the resin required for the potting, and the capacity of the recess means is not more than 10% of the maximum volume of the resin to be filled.

Other objects, operation and features of the present invention will become manifest to those skilled in the art upon making reference to the following detailed description of the preferred embodiments and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a top plan view of an integrated substrate to be used in an IC package according to one embodiment of the present invention;
Fig. 2 is a view illustrative of a method of producing an IC package incorporating therein the substrate shown in Fig. 1;
Fig. 3 is a top plan view of the integrated substrate of Fig. 1 subjected to potting of a resin;
Fig. 4 is a cross-sectional view taken along the line IV-IV of Fig. 3;
Figs. 5, 6 and 7 are top views showing modified integrated substrates used in other embodiments of the present invention, respectively;
Figs. 8 and 9 are cross-sectional views taken along the line VIII-VIII of Fig. 5 and the line IX-IX of Fig. 7, respectively;
Fig. 10 is a cross-sectional view showing an IC package incorporating therein the substrate shown in Fig. 1;
Fig. 11 is a cross-sectional view showing an IC card incorporating therein the IC package shown in Fig. 10; and
Fig. 12 is a plan view showing the IC card shown in Fig. 11.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Fig. 1, a substrate 11 for an IC (integrated circuit) package has a rectangular shape (7 mm x 9 mm). A surrounding wall 12 is

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mounted on the substrate 11 so as to define therebetween a cavity 2. The substrate 11 and the surrounding wall 12 are integrated into an integrated substrate 1 and they are made of epoxy resin with glass fiber filler. The integrated substrate 1 has a thickness of 0.8 mm. The surrounding wall 12 has a continuous groove 4 extending to surround the cavity 2. The groove 4 has a width of 0.2 mm and a depth of 0.1 mm to 0.2 mm. The groove 4 communicates with the cavity 2 through four communication passages 41.

A method of forming a package for an IC card using the integrated substrate 1 of Fig. 1 will now be described with reference to Figs. 2 to 4 and 10.

First, the IC chip 3 is placed at a central portion of the substrate 11. The substrate 11 incorporates a wiring board 31 having lead terminals 311 and input/output terminals 312, both of which terminals 311 and 312 are electrically connected with each other through a communication holes 313 formed in the substrate 11. The IC chip 3 is connected or wire-bonded with the lead terminals 311 through gold wires 5 as shown in Fig. 10.

Then, the cavity 2 is filled with a viscous resin material 6 (for example, epoxy resin or silicone resin) in a liquid state in an amount more than the volume of the cavity 2. Subsequently, a press plate 7 is abutted at its flat smooth surface 71 against the resin 6, and is pressed against the substrate 1. The excess of the resin 6 overflowing from the cavity 2 flows into the groove 4 via the communication passages 41. Then, ultraviolet ray is applied to set or cure the resin 6. After the resin 6 is completely cured, the press plate 7 is released from the integrated substrate 1.

With this method, an IC package 10 can be obtained, in which the exposed surface of the cured resin 6 is formed in a high degree of flatness without grinding (Fig. 10).

In case that the IC package 10 thus produced according to the above-mentioned procedure is incorporated within an IC card, a card body 20 of a multilayer laminate is provided at first, shown in Figs. 11 and 12. The card body 20 is provided with a recess 21 for the IC package 10 and on one end surface thereof with a magnetic strip 22. Adhesives 23, for example epoxy resin, are applied to an inner periphery of the recess 21 of the card body 20 and the IC package 10 is so put onto the recess 21 that the input/output terminals 312 is located to be disclosed outward. Subsequently, pressure is applied to the IC card body 20 under a mositened condition to cure the adhesives 23 and then the IC card is obtained.

In this embodiment, in order to facilitate the release of the press plate 7 from the substrate 1, the press plate 7 is made of polytetrafluoroethylene. However, any other suitable material which facilitates this release can be used. For example, the press plate 7 may comprises a glass plate applied with or coated with silicone. Also,the abutment surface 71 of the press plate 7 may be satin finished or corrugated, instead of flat and smooth one. In this case, an anchor effect of an adhesive can be enhanced when bonding the package to a mating device or element.

The effective capacity of the groove 4 is substantially equal to a volume corresponding to a difference between the maximum volume of the resin to be filled and a volume of the resin required for the potting. In this embodiment, the effective capacity of the groove 4 is substantially equal to 10% of the volume of the resin filled, which volume is about 30 mg.

Figs. 5 and 8 shows another embodiment of the invention which differs from the embodiment of Figs. 3 and 4 only in that an inner peripheral surface of a groove 4 is expanded or extended to the outer periphery of the cavity 2.

Fig. 6 shows a further embodiment of the invention. In this embodiment, groove means 8 is composed of four discontinuous groove portions 82 to 85 disposed to surround the cavity 2. Each of the groove portions 82 and 85 communicates with the cavity 2 through a respective one of communication passages 81.

In a further embodiment shown in Figs. 7 and 9, instead of the groove, a plurality of dimples 9 are formed in the surrounding wall 12. Each of the dimples 9 communicates with the cavity 2 through a respective one of communication passages 91.

These modified substrates achieve similar effects achieved by the substrate of Fig. 1.

Claims

1. An IC package comprising:
an integrated circuit chip (3);
a substrate (11) on which said integrated circuit chip is mounted;
a wall (12) for surrounding said integrated circuit chip, said surrounding wall being placed on said substrate to define therebetween a cavity (2); and
resin for sealing said integrated circuit chip, with which said cavity is filled;
characterized in that
recess means (4) are provided in said surrounding wall and are communicated with said cavity; and
that said resin additionally fills said recess means.

2. An IC package according to Claim 1, wherein a difference between a maximum volume of resin to be filled into said cavity and a desired volume of resin to be filled is smaller than 10% of said maximum volume of resin to be filled.

3. An IC package according to Claim 1, wherein an

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effective capacity of said recess means is substantially identical to a volume corresponding to a difference between a maximum volume of resin to be potted and a desired volume thereof.

4. An IC package according to Claim 1, 2 or 3, wherein said recess means includes a continuous groove or a discontinuous groove extending to surround said integrated circuit chip.

5. An IC package according to Claim 1, 2 or 3 wherein said recess means includes a plurality of dimples.

6. An IC card characterized in that it comprises
an IC card body provided with a recess portion; and
an IC package in accordance with one of the preceding claims, said IC package being fixed into said recess portion of said IC card body.

7. An IC card according to Claim 6, wherein said IC package is fixed to said IC card body through an adhesive layer.

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FIG. 1

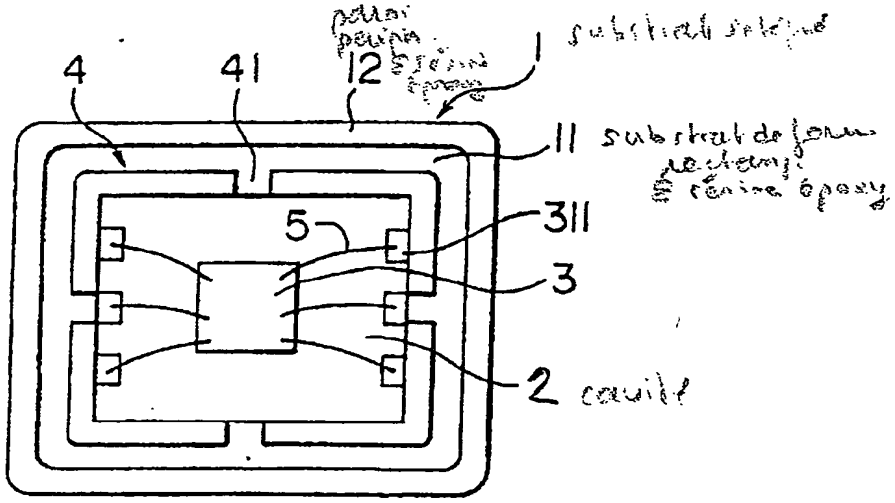


FIG. 2

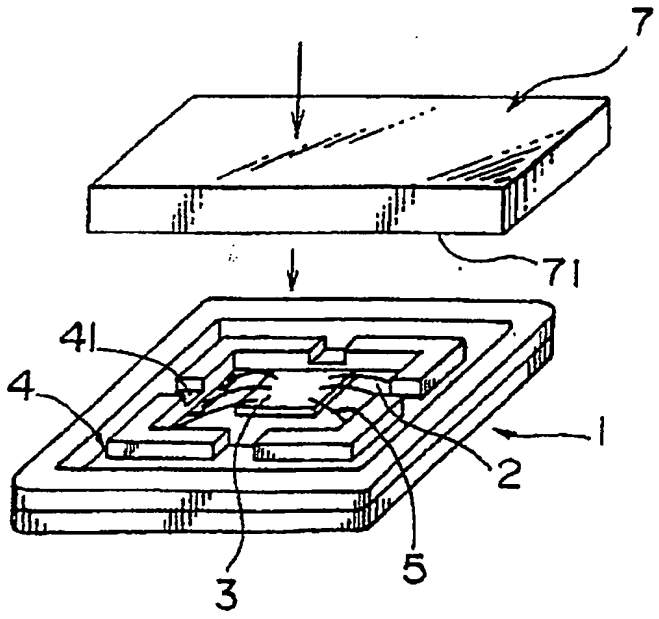


FIG. 3

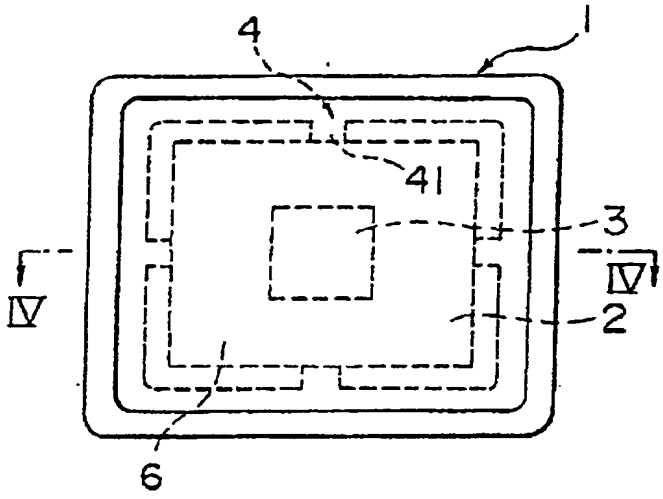


FIG. 4

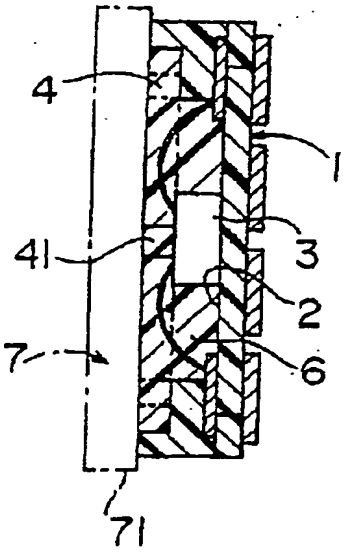


FIG. 5

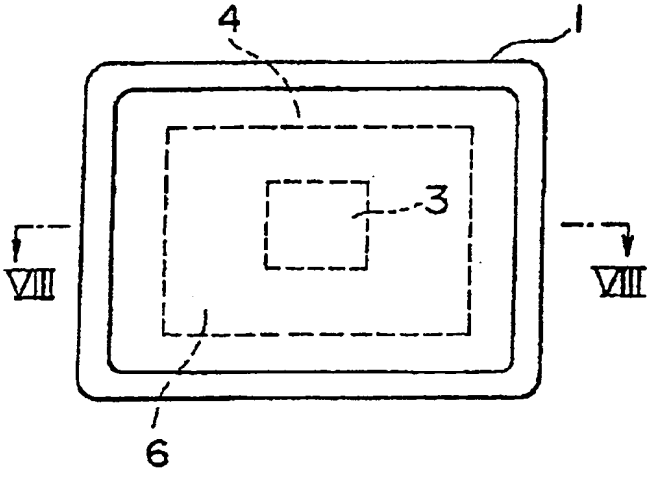


FIG. 8

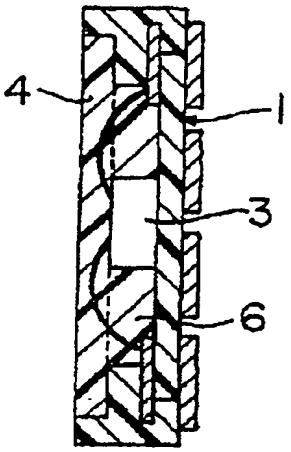


FIG. 6

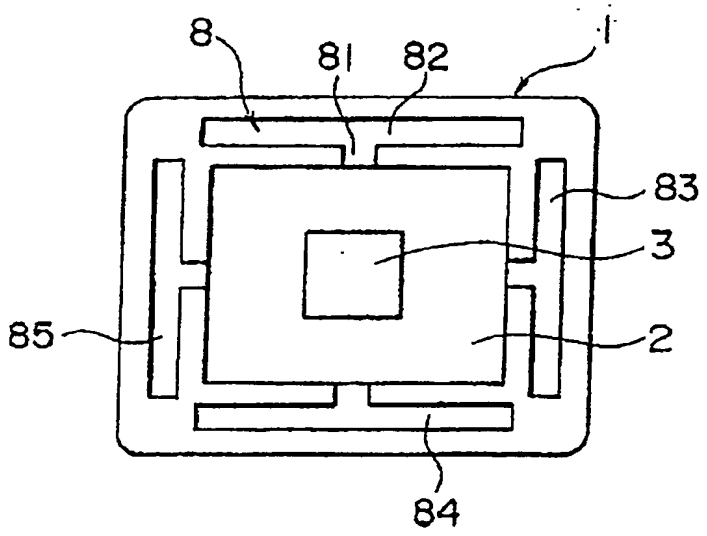


FIG. 7

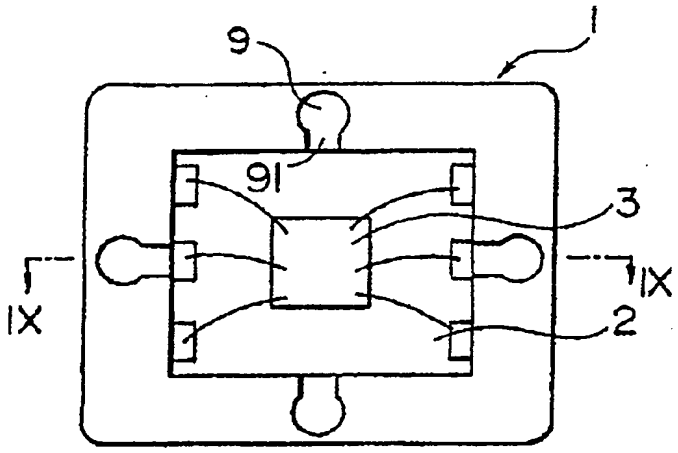


FIG. 9

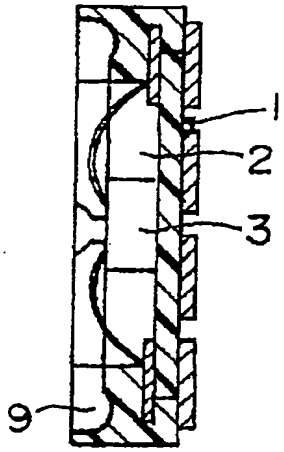


FIG. 10

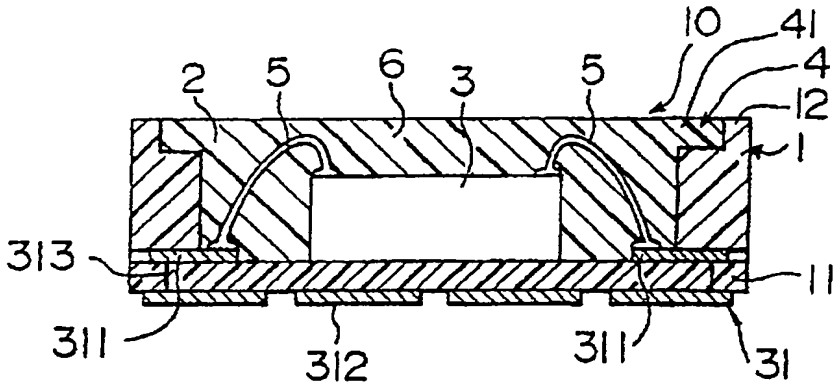


FIG. 11

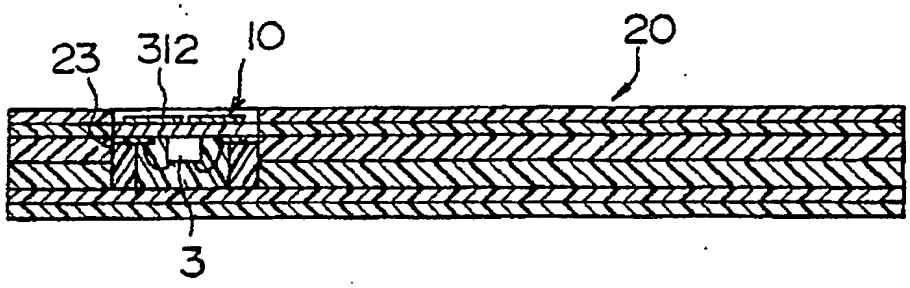
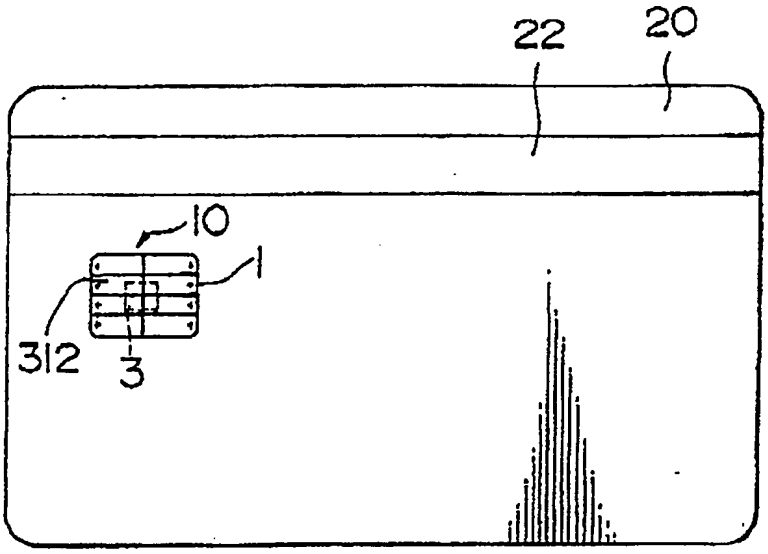


FIG. 12



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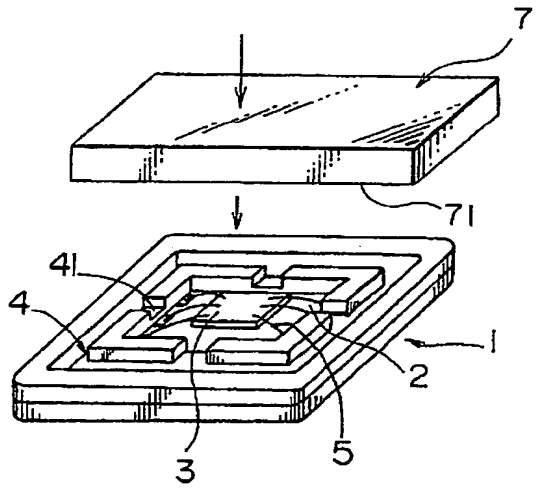

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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 5314

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	PATENT ABSTRACTS OF JAPAN, vol. 12, no. 65 (E-586)[2912], 27th February 1988; & JP-A-62 208 651 (MITSUBISHI) 12-09-1987 * Whole document *	1	H 01 L 23/498 H 01 L 23/24
Y	EP-A-0 231 937 (HITACHI MAXELL) * Page 2, lines 20-31; figures 9-10 *	6	
A	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 325 (E-368)[2048], 20th December 1985; & JP-A-60 157 241 (MITSUBISHI) 18-08-1985 * Whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H 01 L

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	14 May 91	GREENE S.K.

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